Feature Article

Solar Power Tree

Here's an idea for a Solar Power Tree that uses up very less land and yet generates much more energy from the sun's rays.

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Solar Power Tree for 1 kwh (Area 2.25 sq ft)

WITH demands for energy increasing with every passing day and energy generation from the available carbonaceous compounds posing the threat of greenhouse gas effect to the planet, there are worldwide efforts to tap into non-conventional energy sources. Renewable sources of energy or green energy sources like solar energy, wind energy, tidal power, hydro power etc. are most favoured today. However, given its abundance, power from the sun is the only major alternative as compared to other sources of renewable energy that are being tried to replace the conventional sources of energy like coal, gas, oil etc.

But tapping the power of the sun by harnessing its rays is not an easy job. Many ways have been devised from time to time for absorbing the sunrays coming towards the surface of the earth. The most efficient and simplest is the crystalline silicon photo voltaic (PV) module in solid form. There are other forms like amorphous or thin film etc., but the most efficient is the solid crystalline PV cell for direct absorption of sunlight. The other methods of sun absorption like reflection, concentration, water heating etc. are costly and complicated and the efficiency is also less compared to solid PV modules.

In India, solar power generation systems are generally being designed around the solid crystalline (PV) panels. One needs to erect the PV panels at an angle under the sun so that the surface of the panel gets the maximum sun of the day. Therefore, it is required to have a suitable structure over the landed area in an open space to hold the solar panels.

For example, the generation of 2MW power from a PV module system requires land of 10-12 acres approximately for housing the panels only. But land is going to be the greatest crisis on the earth—in fact, it is already a burning question in most countries. Cultivable land if used for purposes other than agriculture could lead to uncountable loss. Many national projects are also facing the severe problem of utilization of land. Therefore, if vast tracts of land are used for capturing solar power it would never be cost effective and viable for the human society.

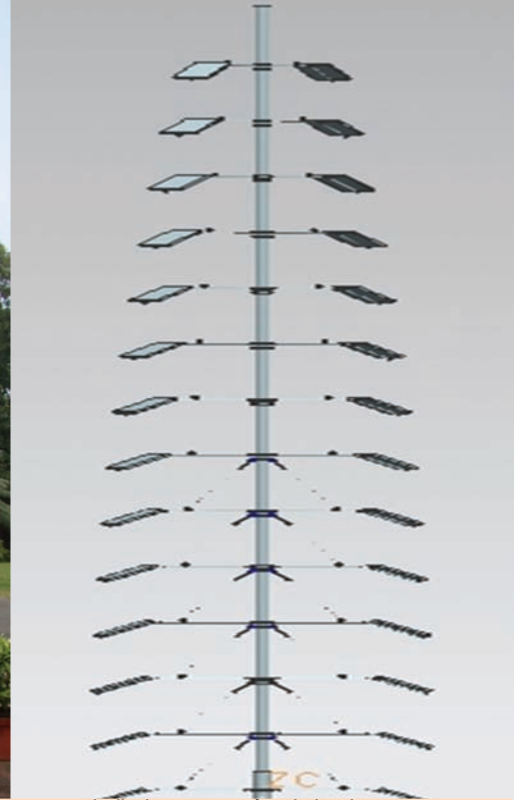
Therefore, there is a need for devising a method and fabricating a suitable device so that the solar power can be absorbed without occupying much surface area or land which is going to be the costliest commodity in the near future. Rather, the device and method should be such that it would be utilizing the minimum land for maximum solar energy absorption by creating maximum solar surface. This is only possible by devising a holding system of PV modules with a tall vertical pole

Conventional layout for 2 kwh (area 500 sq ft)

Conventional solar plant

Model of conceptual Solar Power Tree

Conventional solar panel & light



Proposed tall solar power tree for 2 kwh with PV Panels or Thin Films (area 5 sq ft)

standing on the ground holding the PV panels at a height.

The tall metallic pole of 50 to 70 feet height is founded on a basement of 2 X 2 sq feet or maximum 3 X 3 sq feet area. The maximum surface land thus used is merely 4 to10 sq feet. Of course, it needs some foundation for holding the taller pole but most of the foundation work will be under the ground level.

The uniqueness of this single pole system is that the solar PV modules will be installed throughout the tall pole following a pattern of spiralling phyllotaxi with due adjustment of load distribution over the pillar for its balancing and having reducing stem diameters from the bottom to top so that the shadows of upper panels would not interfere with the lower ones.

The other uniqueness is that all the solar panels will be hanging through their connecting stem-system attached with the main trunk (Pole) and may be made flexible in all directions so that they can best avoid the wind pressure due to heavy storm affecting the main pillar (trunk). Though the leaves (panels) will be spring-loaded and the joints of stems are flexible, they will be naturally facing towards the sun so that they can tap the maximum energy of the sun energies during the daytime.

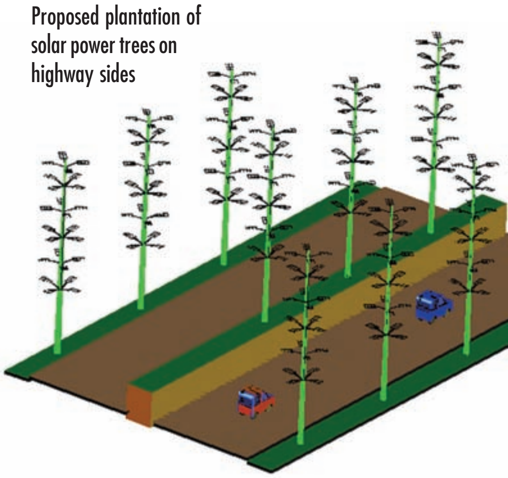
The major advantage of this system is that it takes about 1% of land area in comparison to general PV housing layout. For example, the proposed idea would requires 0.5 sq m basement for 2.2 KWH PV power whereas for the same solar power by the currently used method of housing the PV arrays a land of 50 sq m would be required.

The other advantage is that this system does not require acquiring of big landed property at a single place. Rather, for this type of solar power generation, road sides, islands in between wide roads, boundary walls of paddy lands, crossings of boundary walls etc. can be used.

Another advantage is that the shadow being created by the panels will not touch the land in most of the cases (as trees would be very tall) and even if it touches will not cover the surrounding field by its penumbra (as the individual panels are of small size) so that growth of plants would not be restricted in the cultivable land.

Just to take one example. If both the road side and island of the National Highway from Kolkata to Asansol (approximately 300 km) is used for plantation of solar power trees (SPT) it would produce about 110 MWH of solar energy which would otherwise require a piece of land of almost 700 acres for production of the same energy by the conventional method of panel layout.

Proposed plantation of solar power trees on highway sides



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